BSC 307 Concrete Lesson Plan Form

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| Title:  Lights…camera…Photosynthesis! | Grade Level:  9 |
| Objectives:  The student will be able to:  1. Demonstrate the reactions that occur during both the light cycle and Calvin Cycle  2. Differentiate between the products and reactants of the light cycle and Calvin Cycle. | |
| Illinois State Learning Standards:  ILS Stages H 12 A 1 | |
| Activity Description:  This activity will have students assigned to be a specific molecule, cellular structure or environmental factor involved in either the light cycle or Calvin cycle. Students will then be lead through the processes of photosynthesis and respiration by moving around the room when instructed to in accordance to their molecule’s role in photosynthesis. Lights will be dimmed or turned off to represent night time for the Calvin cycle. Each molecule will be represented by a laminated note card and certain parts of the cycle like photosystem I will be denoted by colored arm bands. | |
| Assessment Strategies: Assessment will consist of students participating in the activity, class discussion and bi-weekly quiz. Information and concepts displayed in the activity will also be tested on at the end of the unit exam. | |
| Rationale:  It is difficult for students to sometimes visualize chemical reactions such as those that occur in photosynthesis. By having students act as molecules, this helps to model the processes of photosynthesis and respiration by placing them in the heart of the reaction. This follows ILS 12 A 1 because it allows the students a way to visualize the chemical reactions that occur in photosynthesis and respiration. | |
| Resources:   |  | | --- | | Illinois State Board of Education. (1997). Illinois State Learning Standards. [On-  line]. Retrieved on January 27, 2011. Available:  http://www.isbe.net/ils/Default.htm.  Riedell, K. (2008). Biology Theater: Photosynthesis. [On-line]. Retrieved on  January 30, 2011. Available:  http://local.brookings.k12.sd.us/biology/teacherlinks/photosynactivities.htm | | |

**\*This guide is the work of Kelly Riedell and contains a few modifications from her original design which can be found at http://local.brookings.k12.sd.us/biology/teacherlinks/photosynactivities.htm\***

**Teachers Guide:**

**# OF CARDS YOU WILL NEED:**

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| --- | --- |
| **1 ATP synthase 1 Stroma 1 Thylakoid space 1 Photosystem II 1 Photosystem I 1 Calvin cycle 1 water** | **4 Electron Transport Chain (ETC) 32 electron cards 12 ADP 12 NADP+ 12 P 24 CO2 8 O 32 H+** |
| **\*optional\* Have students wear color coded armbands to further distinguish their role.** | **Red: ATP Synthase**  **Blue: Water**  **Green: Photosystem I**  **Yellow: Photosystem II**  **Black: Calvin Cycle**  **White: Electron Transport Chain** |

**Also, prior to beginning activity make sure you place some sort of adhesive like double sided tape to the NADP cards and ADP cards. This will allow students to attach either hydrogen cards or phosphate cards to the appropriate card and form the molecules.**

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**ACT IT OUT  
ELECTRON TRANSPORT:**

**Students wear appropriate name tags and/or colored arm bands and line up in correct position.  
Photosystem II, ETC, ETC, ETC, Photosystem I, ETC, ATP synthase stand in a line  
Sun stands to side of PS II.  
Stroma stands in front of line.  
Thylakoid space stands behind line.  
Water stands next to thylakoid space.  
ADP stands near ATP synthase  
NADP+ stands near ATP synthase and last ETC**

**Roles:   
Sun: Holds flashlight and shines it on Photosystems (\*Note\* you can use the classroom lights to act as the sun overhead and have students act as photons and hand off a photon card to photosystem II. If you choose this option, create a few photon cards for students to use)  
PS II: passes e- cards to last ETC  
ETC: Passes e- cards along line and hands H+ cards over shoulder to thylakoid space  
PS I: Passes e- cards to LAST ETC  
WATER: Passes e- cards to PS II  
THYLAKOID SPACE:  Receives H+ cards from ETC and passes H+ cards to ATP synthase  
ATP SYNTHASE:  receives H+ cards from thylakoid space  and passes them to stroma; holds P cards and attaches them to ADP.  
LAST ETC: collects all e- cards as they come down line, receives H+ from stroma and gives 2 e- cards and attaches an H+ to NADP+**

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SPLITTING WATER****:  
Assign 6-8 students to be water molecules in THYLAKOID SPACE.  
Each starts wearing an O card with 2 H's attached and holds 2 e- cards.**

**As water is split, the H+ cards are detached and are passed to the THYLAKOID SPACE.  
The 2 e- cards pass to PS II, and the leftover O holds hands and joins with another O to become O2 and leaves the chloroplast (room, other option is to have students take a seat on one side of the room).**

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**Actors:  
12 students each hold 1 CO2 card, ATP and NADPH from light reactions  
  
CO2, ATP and NADPH travel to CALVIN CYCLE.  
ATP removes its P, NADPH removes its H+ and passes it and 2 e- cards to CALVIN CYCLE.   
CO2's hand their cards to CALVIN CYCLE.**

**CALVIN CYCLE takes 2 e- and H+ from NADPH, and energy and P from ATP and  
CO2's  hold  their cards and CALVIN CYCLE links their arms to form a 6 person ring\*  
   OR they can all form a ring and hold their CO2 cards together in the middle.**